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REPORT OF AN ALASKAN OUTBREAK

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REPORT OF AN ALASKAN OUTBREAK

Capt. Clifford E. Butler,  
Wayne L. Miller,  
Charles T. Marrow and  
Raymond D. Evans

## FOREWORD

Research reported in this paper was done by the Arctic Aeromedical Laboratory, Arctic Pathoecology Branch, under Project 8241, Task 824101, and by the Northern Regional Laboratory, Alaska Department of Health and Welfare, Fairbanks, Alaska, from 24 September 1964 to 1 March 1965. This was a special project in response to a request from the civilian medical community. Capt Butler, USAF, is with the Arctic Aeromedical Laboratory; Mr. Miller is a Bacteriologist, Northern Regional Laboratory, Alaska Department of Health and Welfare; and Dr. Marrow and Dr. Evans are with Fairbanks Medical and Surgical Clinic.

The authors gratefully acknowledge the entire team of technicians, nurses and other personnel who assisted during this outbreak. Special recognition is given to SSgt Charles E. Busbee, USAF, and Mrs. Susan Carter, RN, for their long hours and valuable assistance. The authors express sincere appreciation to the Bristol Laboratories, Syracuse, New York, for supplying without charge the Polycillin (ampicillin trihydrate) used to treat students at the University of Alaska.

This technical report has been reviewed and is approved.

Horace F. Drury  
HORACE F. DRURY  
Director of Research

### ABSTRACT

In the central part of Alaska, gastroenteritis is a perennial problem, with the incidence rate reaching almost epidemic proportions in the early summer and early autumn. The causative agents appear to be both viral and bacterial. In 1964 during the autumn epidemic, Salmonella anatum invaded the University of Alaska campus along with a probable viral infection. Approximately 300 students developed symptoms of gastroenteritis during this outbreak but only a very small percentage became acutely ill. Thirty-five students and eight food handlers were found to be infected with Salmonella anatum. A therapeutic history of the outbreak showed Polycillin (ampicillin) to be very effective in eradicating the organisms from the patients.

## I

### INTRODUCTION

Each year the populace of Central Alaska experiences an increase in the incidence rate of gastroenteritis that coincides with the arrival of warm weather. The rate remains at a constant high level during the warm months, increases significantly immediately prior to the arrival of cold weather, then remains relatively low during the winter. Symptoms accompanying this gastroenteritis may include nausea, vomiting, abdominal discomfort, diarrhea and headache. There is noticeable absence of a fever in most instances. The infection is generally more irritating than debilitating and persists from 24 to 72 hours. A causative agent for the majority of these cases has not been found but it is generally considered to be a virus. It is known that *Salmonella* and *Shigella* are also more prevalent during these periods.

During the 1964 autumn epidemic 25 to 30 students at the University of Alaska reported to the health center in one 24-hour period complaining of gastroenteritis. While most of the students had mild, varying symptoms, four were found to be acutely ill with fevers ranging from 103° to 104.6° F. These four were hospitalized. Rectal swabs were taken immediately upon admission of the student.

A preliminary examination of the culture plates showed colonies suspicious for enteric pathogens. A slide agglutination test with *Salmonella* polyvalent somatic antisera was strongly positive.

As soon as the preliminary reports were received the school physicians requested an epidemiological investigation. The investigation was conducted by the Alaska Department of Health and Welfare, assisted by the USAF Arctic Aeromedical Laboratory.

## II

### INVESTIGATION PROCEDURE

The initial investigation began with the four hospitalized students. The common factor was that all became ill within a few hours after the Monday night's supper served at the University cafeteria. Each student also stated that several fellow students had become ill with similar but less acute symptoms during this period. A check of the health center records show that 40 students had reported gastroenteritis between lunch on the preceding Monday and the time when the investigation began. However, only the four displayed elevated temperatures and acute symptoms.

All students who had reported gastroenteritis were traced and brought back to the health center. Some of these students were no longer experiencing symptoms and the rest were experiencing light symptoms. A complete history of activities was taken from each student including food and liquid ingested, and a rectal swab was obtained.

Other students who had experienced symptoms but did not report to the health center were traced and asked to report to the health center. All new cases were also interviewed and a rectal swab obtained.

After the first 30 students were interviewed it became apparent that the campus cafeteria was the focal point and the Monday night supper appeared to be the original probable attack meal. Arrangements were made to obtain food samples and surface swabs from the campus cafeteria and snack bar and to have all food handlers report for an interview and rectal swab. Although food samples were not available from the attack day, items from the same lot were taken from storage. Particular attention was given to those items of food usually associated with this type outbreak.

### III

#### INVESTIGATION RESULTS AND CONCLUSIONS

Cultures were made on samples from 300 individuals during this outbreak. This included approximately 215 students, all experiencing gastroenteritis symptoms in some form; 84 part-time or full-time food handlers who were asymptomatic; and one part-time food handler, a student, who experienced mild symptoms.

Of these 300 individuals 43 were found to be positive for Salmonella anatum. These 43 included 35 students, 4 full-time food handlers and 4 part-time student food handlers. Enteric pathogens were not recovered from the food samples or surface swabs.

It should be noted that 17 of the first 30 students and 2 of the first 22 food handlers were positive. This indicated a rather massive outbreak. However, only 6 of the next 42 individuals were found positive and the remaining 18 positives were found grouped sporadically in the remaining 200 plus individuals.

Estimating that an individual became infected during the 24-hour period preceding the onset of symptoms, it appears that 19 of the individuals with symptoms were infected during the original attack day (Table I). Fifteen were infected during the next week and one was not discovered until eight weeks later. The information from the last positive case indicates that this individual acquired the infection earlier but did not report the symptoms at that time.

TABLE I

## Symptoms of Positive Patients in Relation to Attack Meal

	Number Having Symptoms
<u>Before attack meal</u>	2
<u>After attack meal</u>	
Within 12 hours	16
Within 12-24 hours	1
Within 24-48 hours	1
Within 48-72 hours	1
Within 72-96 hours	3
Within 4-5 days	1
Within 5-6 days	0
Within 6-7 days	4
Within 7-8 days	5
Within 8 weeks	1
	<hr/>
Total:	35
Number having no symptoms	8
	<hr/>
Total:	43

Since seven of the eight food handlers denied symptoms it is impossible to estimate when these individuals acquired the organism.

It is the conclusion of the investigators that this outbreak was initially food handler borne.

The pattern of the outbreak indicates that initially isolated servings of food and/or utensils were contaminated by one or more food handlers and passed directly to the students. A cook and line-server, both asymptomatic and positive for Salmonella anatum, were in a position to do this. After the initial attack dissemination appeared to have been by several modes.



This conclusion is also based on the low attack rates. Over 500 individuals were served at each meal during the attack day(s) but no more than 40 individuals reported symptoms and no more than 19 were actually infected during any 24-hour period.

It is also the opinion of the investigators that many of the students who were experiencing symptoms were victims of the viral infection rather than the Salmonella.

#### IV

#### COMMENTS

##### Isolation and Identification Procedures

Two different laboratories were involved in the investigation. Thus, two different types of procedures for isolation and identification were used; however, both utilized the usual media. In describing the procedure it should suffice to note that one laboratory utilized 1% peptone water and one laboratory utilized Hajna (Baltimore Biological Laboratory (BBL)) Broth as a preservative. Both worked well. For enrichment, one laboratory used Selenite Broth (DIFCO) and one used GN Broth (BBL) and Selenite Cystine Broth (BBL). All three broths worked well. For isolation, one laboratory utilized MacConkey's and SS agar plate (full plate) and one laboratory utilized MacConkey's SS, Desoxycholate Lactose Sucrose, and Brilliant Green Agar (1/4 plate). While all these media worked well, MacConkey's was the medium of choice. In every instance where duplicate cultures on the same patient were examined by the two laboratories there was complete agreement. Both laboratories were able to submit a preliminary report within 48 hours and every culture submitted to the Communicable Disease Center was confirmed.

#### V

#### THERAPEUTIC NOTES

The therapy utilized during this outbreak presents an interesting pattern. In the discussion of the therapy regimen two individuals will be omitted; one patient had to undergo surgery and was treated in a different manner from the rest, and one left the area before therapy began. The other 41 individuals can be followed closely.

For clarity the 41 positive patients must be divided into two groups: One group consists of 37 individuals who were given primary or secondary treatment by the school physicians, and the other group consists of four individuals all full-time food handlers, who were treated by a private physician.

(Therapeutic information on these four patients was furnished by Dr. H. G. Storrs, Fairbanks, Alaska) The same therapeutic agents were used by all the clinicians; however, the regimens differed. These therapeutic agents included neomycin, tetracycline (Achromycin), Chloromycetin (chloramphenicol), Humatin (paromomycin), and Polycillin (ampicillin).

The efficacy of the agents was based on two aspects: the clinical aspect, i. e., the elimination of symptoms; and the bacteriological aspect, i. e., the eradication of the organism from the patient. From the clinical aspect all the therapeutic agents were effective since symptoms were eliminated in all but one of the patients in three to seven days after therapy began. However, from the bacteriological aspect most of the agents were not so effective.

### Positive Food Handler Therapy

The food handlers were given a concentrated course of therapy consisting of as many as three therapeutic agents simultaneously. The post-therapy cultures were taken on these individuals within a three-week period. All of these individuals became culturally negative within one week following the therapy.

The therapy was as follows: Three patients were given a single course consisting of neomycin (2 gm per day for 5 days) plus tetracycline (1 gm per day for 7 days) plus ampicillin (1 gm per day for 7 days). The other patient was given an initial course of chloromycetin plus tetracycline (1 gm per day for 2 days) followed immediately by neomycin (2 gm per day for 5 days) and ampicillin (1 gm per day for 7 days).

### Positive Student Therapy

A modified regimen of therapy as described by Murdoch (1) was prescribed for the positive students. A summary of the regimen for these 37 individuals and the bacteriological efficacy are presented in Table II.

### Sensitivity Test Results and Comparison

Organisms from all patients who failed to readily respond to therapy were examined for in vitro sensitivity. In this report only those agents actually used in vivo and four representative in vitro patient results will be discussed. The disc-agar method was used for three of the agents and the tube dilution method was used for two of the agents. Results are summarized in Tables III and IV.



TABLE III

In Vitro Disc-Agar Results of Four Patients

Agent	Disc Conc.	Patient No. 1			Patient No. 2			Patient No. 3			Patient No. 4		
		Culture No.			Culture No.			Culture No.			Culture No.		
		1	2	3	1	2	3	1	2	3	1	2	3
Chloromycetin	30 µg	S	S	S	S	S	S	S	S	S	S	S	S
Tetracycline	30 µg	S	R	R	R	R	R	S	R	R	S	R	R
Neomycin	30 µg	S	R	R	S	S	S	S	S	R	S	R	R
S = sensitive		R = resistant											

TABLE IV

In Vitro Results by Tube Dilution Method  
(Mcg/ml)

Agent	Patient No. 1			Patient No. 2			Patient No. 3			Patient No. 4		
	Culture No.			Culture No.			Culture No.			Culture No.		
	1	2	3	1	2	3	1	2	3	1	2	3
Paromomycin	6.25	6.25	12.5	6.25	6.25	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Polycillin	-	7.5	15	7.5	15	30	15	15	15	15	15	15

In both Tables III and IV, Culture No. 1 indicates sensitivity of the organism before therapy, Culture No. 2 indicates sensitivity after one course of therapy and Culture No. 3 indicates sensitivity after a second course of therapy.

These results indicate that the resistance of the organism was increasing rapidly in the patients and that organisms recovered from the later infections were a more resistant form. Although all of the patients but one responded bacteriologically to the therapy, those with the organisms that showed more resistance in vitro responded more slowly to the therapy.

### Allergenic Reactions to Polycillin

Six of the 19 patients treated with ampicillin developed an allergenic reaction. In every instance the reaction appeared as a urticaria with no renal, hepatic or hematological involvement. The allergenic reactions occurred on the 5th, 8th, 10th, 17th, 20th and 21st day respectively. In each instance therapy was discontinued on the day the urticaria began. Fortunately, all of these patients responded readily to the therapy and three post-therapy cultures showed that the organism had been eradicated even after an abbreviated regimen.

## VI

### DISCUSSION

This outbreak in Fairbanks, Alaska, was only one of 52 outbreaks reported in the United States in 1964 (2). It was not totally unexpected. Over 20 species of *Salmonella*, *Shigella* and related potentially pathogenic members of the bacterial family Enterobacteriaceae had been recovered in the Fairbanks area during the preceding 18 months (3). Although most of these organisms had been found in sources other than humans during this period, the presence of the organisms indicated that a consistent potential hazard existed.

A close surveillance of enteric infections in the Fairbanks area has been maintained for many months following this outbreak. Due to the unusual weather conditions, it was believed that an entire 12-month cycle of freezing, warming, thawing and refreezing was necessary before it could be definitely ascertained that the outbreak had been eradicated. Although several species of *Salmonella* have been recovered from humans and animals in the area during the surveillance period *Salmonella anatum* was conspicuously absent.

## REFERENCES

1. Murdoch, J. McC. "Salmonellosis (other than typhoid fever)." In: Current therapy. H. F. Conn, ed. Philadelphia, W. B. Saunders Co. 1964, pp 45-46.
2. "Salmonella surveillance." Annual Summary 1964. Communicable Disease Center, Atlanta, Georgia, U. S. Department of Health, Education and Welfare, Public Health Service, Oct. 13, 1965. pp 1-2.
3. Butler, C. E. and B. R. Herd. "Human enteric pathogens in dogs in Central Alaska." J. Inf. Dis. 115:233-236, 1965.

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